WE CLAIM:

1   1.   A serial communications system comprising:

2   a scrambler for converting received data into scrambled data; and

3   an ECC encoder for converting said scrambled data into ECC-encoded data.

1   2.   The system as recited in Claim 1, further comprising:

2   a serializer for converting said ECC-encoded data into serialized data;

3   wherein the ECC-encoded data includes frame alignment information; and

4   the system further comprises a receiver for receiving said serialized data and

5 converting the serialized data into data frames based upon the frame alignment information.

1   3.   The system as recited in Claim 2, wherein the receiver comprises:

2   a frame-recoverer for converting said serialized data into data frames;

3   an ECC decoder for converting said data frames into ECC-decoded data and

4 error indications; and

5   a scrambler for converting said ECC-decoded data into de-scrambled data.

1   4.   The system as recited in Claim 5, wherein said frame-recoverer uses said error

2 indications in converting said serialized data into data frames.

1   5.   The system as recited in Claim 1, wherein said ECC encoder applies an error

2 correction code in converting said scrambled data into said ECC-encoded data.

1   6.   A serial communications method, comprising the steps of:

2   converting received data into scrambled data; and

3   converting said scrambled data into ECC-encoded data.

1   7.   The method as recited in Claim 6, further comprising the steps of:

2   generating a serial stream of the ECC-encoded data; and

3   transmitting said serial stream.

1   8.   The method of Claim 7, wherein:

2   the ECC-encoded data includes frame alignment information; and

3   the method further comprises receiving said serialized data and converting said

4   serialized data into data frames based upon said frame alignment information.

1   9.   The method of Claim 7, further comprising:

2   receiving said serialized data;

3   converting said serialized data into data frames;

4   converting said data frames into ECC-decoded data and error indications; and

5   converting said ECC-decoded data into de-scrambled data.

1   10.   The method of Claim 9, wherein the step of converting the serialized data

2   comprises converting the serialized data into data frames based upon said error indications.

1   11.   A serial communications system comprising:

2   an ECC decoder for converting data frames into ECC-decoded data; and

3   a de-scrambler for converting said ECC-decoded data into de-scrambled data.

1   12.   The system of Claim 11, further comprising a frame-recoverer for converting

2 serialized data into said data frames.

1   13.   The system as recited in Claim 12, wherein:

2   said ECC decoder generates error indications; and

3   said frame-recoverer uses said error indications in converting said serialized

4 data into said data frames.

1   14.   The system as recited in Claim 13, wherein said frame-recoverer generates a

2 frame clock that is shifted in phase based upon said error indications, said frame-recoverer

3 converting said serialized data into said data frames using said frame clock..

1   15.   The system as recited in Claim 14, wherein said frame-recoverer shifts in

2 phase said frame clock by a predetermined number of periods of a bit clock based upon said

3 error indications.

1   16.   The system as recited in Claim 13, wherein said frame-recoverer comprises:

2   a plurality of registers, each register being controlled to receive said serialized

3   data and form two or more frames of parallel data therefrom;

4   a selection control circuit for receiving said error indications and generating at

5   least one control signal; and

6   selection circuitry coupled to receive as inputs the output of said registers and

7   said control signal from said selection control circuit, and output a set of parallel data

8   appearing at the input of said selection circuitry, said number of bits in said set of parallel

9   data corresponding to the number of bits in a frame of data.

1   17.   The system as recited in claim 16, wherein

2   the selection circuitry comprises a plurality of individual multiplexer circuits,

3   the number of multiplexer circuits corresponding to the number of bits n in a frame of data,

4   each multiplexer circuit being an n+1:1 multiplexer circuit.

1   18.   The system as recited in Claim 13, wherein said error indications are

2   associated with errors in said data frames, said ECC-decoder correcting some of said errors.

1   19.   A serial communications system comprising:

2   an ECC decoder for converting data frames into ECC-decoded data and error indications; and

3   a frame recoverer for converting serialized data into said data frames using

4   said error indications.

1   20.   The system as recited in Claim 19, wherein said frame-recoverer generates a

2   frame clock that is shifted in phase based upon said error indications and converts said

3   serialized data into said data frames using said frame clock.

1   21.   The system as recited in Claim 20, wherein said frame-recoverer shifts in

2   phase said frame clock by a predetermined number of periods of a bit clock based upon said

3   error indications.

1   22.   The system as recited in Claim 19, wherein said frame-recoverer comprises:

2   a plurality of registers, each register being controlled to receive said serialized

3   data and form two or more frames of parallel data therefrom;

4   a selection control circuit for receiving said error indications and generating at least

5   one control signal; and

6   selection circuitry coupled to receive as inputs the output of said registers and

7   said control signal from said selection control circuit, and output a set of parallel data

8   appearing at the input of said selection circuitry, the number of bits in said parallel set of data

9   corresponding to the number of bits in a frame of data.

1   23.   The system as recited in claim 22, wherein

2   the selection circuitry comprises a plurality of individual multiplexer circuits,

3   the number of multiplexer circuits corresponding to the number of bits n in a frame of data,

4   each multiplexer circuit being an n+1:1 multiplexer circuit.

1   24.   The system as recited in Claim 19, wherein said error indications are

2   associated with errors in said data frames, said ECC-decoder correcting some of said errors.

1   25.   The system as recited in claim 19, further comprising:

2   a de-scrambler for converting said ECC-decoded data into de-scrambled data.

1   26.   A serial communications method comprising:

2   converting serialized data into data frames as a function of error indications;

3   and

4   converting said data frames into ECC-decoded data and said error indications.

1   27.   The method as recited in Claim 26, further comprising:

2   de-scrambling said ECC-decoded data into de-scrambled data.

1   28.   The method as recited in Claim 26, wherein the step of converting said

2   serialized data comprises:

3   generating a frame clock that is shifted in phase based upon said error

4   indications; and

5   converting said serialized data into said data frames using said frame clock.

1   29.   The method as recited in claim 26, wherein the step of converting said

2   serialized data comprises:

3   temporarily maintaining bits of said serialized data sufficient to form two or

4   more frames of parallel bits;

5   selecting a frame of data from said maintained bits based upon said error

6   indications, said frame of data being a frame of data in the data frames; and

7   repeating said steps of temporarily maintaining and selecting for generating

8   each data frame from said serialized data.

1   30.   The method as recited in claim 26, further comprising:

2   initially scrambling received data into scrambled data;

3   converting said scrambled data into ECC-encoded data; and

4   converting said ECC-encoded data into said serialized data.

1   31.   A serial communications method comprising:

2   converting data frames into ECC-decoded data and error indications; and

3   de-scrambling said ECC-decoded data into de-scrambled data.

1   32.   The method as recited in Claim 31, further comprising:

2   initially converting serialized data into said data frames as a function of said

3   error indications.

1   33.   The method as recited in claim 31, further comprising:

2   initially scrambling received data into scrambled data; and

3   performing an ECC encoding operation on said scrambled data to generate

4   said data frames.